

REMARKS

I. Introduction

Claims 9 to 15 and 20 to 22 are pending in the present application. In view of the foregoing amendments and the following remarks, it is respectfully submitted that all of the presently pending claims are allowable, and reconsideration is respectfully requested.

II. Objection to the Specification

The Specification was objected to for various alleged informalities.

Regarding the alleged lack of clarity of the composition of the piezoelectric ceramics discussed in the Specification, the piezoelectric ceramics referred to in the Specification are of the general formula $Pb(Zr_{1-x}Ti_x)O_3$, modified by certain additives, as indicated in the paragraph beginning on page 1, line 19 of the Specification.

Regarding the alleged insufficiency of the term "doped" in defining the composition of the ceramics discussed in the Specification, it is respectfully submitted that this term is sufficiently clear to one skilled in the art and sufficiently defines the composition of the ceramics in the Specification. For example, the first ceramic material listed in the table on page 6 of the Specification is a ceramic of the general formula $Pb(Zr_{1-x}Ti_x)O_3$, doped with neodymium.

Regarding the alleged lack of clarity of the term "RB-doping," once again, it is respectfully submitted that this term relates to the doping described from column 3, line 23 to column 4, line 19 of U.S. Patent No. 6,773,621 ("Hammer et al."), which is the U.S. patent resulting from PCT Application No. PCT/DE01/04694, published as WO02/055450. The dopants used in the compositions of Hammer et al. are clearly shown in the formulas disclosed in the above-mentioned passage.

Accordingly, withdrawal of this objection is respectfully requested.

III. Objection Under 35 § U.S.C. 132(a)

Regarding the objection to the amendment filed on November 17, 2008 as allegedly introducing new matter into the disclosure, although Applicants may not agree with the objection, to facilitate matters, the paragraph beginning on page 4, line 4 of the Specification has been amended to cancel the text added from U.S. Patent No. 6,773,621, thereby rendering moot the objection. Accordingly, withdrawal of this objection is respectfully requested.

IV. Rejection of Claims 11 to 15 Under 35 U.S.C. § 112, 1st Paragraph

Regarding the rejection of claims 11 to 15 under 35 U.S.C. § 112, 1st Paragraph, as allegedly failing to comply with the written description requirement, although Applicants may not agree with the merits of the rejection, to facilitate matters, claims 11 and 13 to 15 have been amended, inter alia, to change “the starting compounds” to --the starting compound mixture--. As the Office Action admits, on page 4, lines 4 to 5, that the originally filed disclosure teaches adding dopants to the starting compound mixture, it is respectfully submitted that the above-mentioned amendments to claims 11 and 13 to 15 obviate the rejection.

Accordingly, withdrawal of this rejection is respectfully requested.

V. Rejection of Claims 11 to 13 Under 35 U.S.C. § 112, 2nd Paragraph

Regarding the rejection of claims 11 to 13 Under 35 U.S.C. § 112, 2nd Paragraph, the Examiner will note that the expression "simply doped" in claims 11 and 13 has been changed to --doped--, as suggested. In addition, the term "rare earth metals" in claim 11 has been changed to --a rare earth metal--, thereby providing sufficient antecedent basis for the term "the rare earth metal" in claim 12. Support for the latter amendment may be found, for example, in the table on page 6 of the Specification.

Accordingly, withdrawal of this rejection is respectfully requested.

VI. Rejection of Claims 9 to 13 and 20 Under 35 U.S.C. § 102(b)

Claims 9 to 13 and 20 were rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,993,895 ("Jang et al."). It is respectfully submitted that Jang et. al does not anticipate these claims for at least the following reasons.

Although Applicants may not agree with the merits of the rejection, to facilitate matters, claim 9 has been amended without prejudice to recite, in relevant part, a method for manufacturing a low-sintering PZT-based piezoelectric ceramic material having the general formula $Pb(Zr_{1-x}Ti_x)O_3$. Support for this amendment may be found, for example, on page 1, lines 22 to 23 of the Specification.

Jang et al. does not disclose, or even suggest, that a sintering temperature in the range of 850°C to 950°C is obtained for a mixture of calcined starting compounds and ionic lithium. In column 3, lines 20 to 28, Jang et al. states the following:

The identical PLZT compound was then modified by an addition of a lithium salt in accordance with the invention and it was found that **the firing temperature could be reduced to as low as 1000° C** for two hours, while still achieving approximately equal energy storage values, for equivalent applied electric fields.

It was determined that the addition of lithium to the PLZT antiferroelectric material **reduced (i) the required firing temperature to about 1100° C or less;** (ii) resulted in approximately equal levels of energy density storage and (iii) did not affect the PLZT in an environment wherein high electric fields are applied.

Thus, contrary to the assertions appearing on page 5, lines 21 to 22 and page 7, lines 2 to 8 of the Office Action, and consistent with the examples shown in Table I, the sintering temperature range disclosed by Jang et al. is not less than or equal to 1100° C, but greater than or equal to 1000° C and less than or equal to 1100° C. Furthermore, regarding the assertion on page 5, lines 6 to 8 of the Office Action:

Since the taught composition and process are identical to that claimed, the taught ceramic must have a sintering temperature in the ranges of claims 9 and 20, absent any showing to the contrary;

the Examiner will note that the PZT ceramics recited in claim 9 have the general formula $Pb(Zr_{1-x}Ti_x)O_3$, whereas the ceramic tested in Jang et al. is a 8/95/5 PLZT in which the molar percentage of L is 8% of that of Pb and the relative molar percentages of Zr and Ti are 95 and 5, respectively. Thus, although the relative percentages of Zr and Ti in Jang et al. match the PZT formula of claim 9, Jang et al. makes no mention whatsoever of the total molar percentages of Zr and Ti with respect to Pb or the relative molar percentage of oxygen from oxides. Thus, the Office Action cannot make the claim that the composition employed by Jang et al. is the same as that of the present Application.

Accordingly, it is respectfully submitted that Jang et al. do not anticipate claim 9 for at least the above reasons.

VII. Rejection of Claims 9 to 13 and 20 to 22 Under 35 U.S.C. § 103(a)

Claims 9 to 13 and 20 to 22 were rejected under 35 U.S.C. § 103(a) as unpatentable over Jang et al. It is respectfully submitted that Jang et al does not render these claims unpatentable for at least the following reasons.

As discussed above in section V of this response, Jang et al. does not disclose, or even suggest, all of the features of claim 9. Accordingly, it is respectfully submitted that Jang et al. does not render unpatentable claim 9 or its dependent claims 10 to 13 and 20 for at least these reasons.

Regarding claim 21, Jang et al. does not disclose, or even suggest a piezoelectric multilayer actuator having internal electrodes made of pure silver. As indicated in column 5, lines 56 to 62, Jang et al. only discloses a silver palladium alloy as metallization. In addition, as the melting point of silver is approximately 960°C (see page 4, lines 20 to 26 of the Specification), the sintering temperatures of 1000°C to 1950°C disclosed by Jang et al. would melt a silver electrode, thereby rendering the piezoelectric actuator nonfunctional. Furthermore, regarding the assertion on page 7, lines 18 to 20 of the Office Action, “There has been no showing that the taught ceramic cannot be sintered at the claimed temperature nor that the taught actuator cannot be formed with silver electrodes,” it is respectfully submitted that it is not the burden of Applicants to show that the ceramic of Jang et al. cannot be sintered at the temperature range claimed in claim 9, but the burden of the Examiner to show that sintering at the temperature range claimed in claim 9 is disclosed by, or obvious from, Jang et al. As discussed above, Jang et al. clearly describes a sintering temperature range of 1000° C to 1100° C and does not suggest sintering at a temperature lower than the above range. In addition, the sintering temperature range disclosed by Jang et al. would melt a silver electrode, and thus, one skilled in the art would not be motivated to employ silver electrodes in an actuator constructed from the ceramic of Jang et al. Accordingly, Jang et al. do not render claim 21 unpatentable for at least these reasons.

Regarding claim 22, as this claim relates to a motor vehicle fuel injection system including the piezoelectric multilayer actuator according to claim 21, it is respectfully submitted that Jang et al. does not render claim 22 unpatentable for at least the reasons set forth above in support of the patentability of claim 21.

In view of all of the foregoing, withdrawal of this rejection is respectfully requested.

VIII. Conclusion

In light of the foregoing, Applicants respectfully submit that all pending claims are in condition for allowance. Prompt reconsideration and allowance of the present application are therefore earnestly solicited.

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